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ABSTRACT

This study was undertaken to examine what would happen if individuals who are intrinsically motivated to perform a cognitive problem-solving task were offered a contingent extrinsic monetary incentive for doing so. Sixty male and 60 female undergraduates at the University of South Florida used microcomputers to complete a cognitive task requiring the storage of information that was later spontaneously transferred and applied to solve problems. Subjects received 10 related and 5 dummy clue statements and then were asked to provide plausible explanations for seemingly implausible events. Subjects were randomly assigned to one of 12 groups based on incentive, gender, and interest level. Four groups received the offer of money prior to the clues, four groups received the offer of money after the clues but before the problems, and four groups received no offer of money. The results indicated that the offer of money for problem solving appeared to dramatically decrease intrinsic motivation and detrimentally affect performance. The findings also suggest that incentives may have interfered in the cognitive storage and retrieval of information. (TE)

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Effects of Extrinsic Incentives on Problem Solving: Motivation, Performance and Recall

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Abstract

If individuals who are intrinsically motivated to perform a cognitive problem-solving task are offered a contingent extrinsic monetary incentive for doing so, what happens to their intrinsic motivation and performance? In an experimental study, participants used microcomputers to complete a cognitive task requiring the storage of information that was later spontaneously transferred and applied to solve problems. Results indicated that the offer of money for problem solving dramatically decreased intrinsic motivation and detrimentally affected performance, and that incentives may have interfered in the cognitive storage and retrieval of information.

Effects of Extrinsic Incentives on Problem Solving: Motivation, Performance and Recall

For years, proponents of operant conditioning have used extrinsic incentives, better-known as reinforcers, to facilitate learning and to control behavior. Others (parents, educators, managers) have offered incentives to motivate and to increase or improve performance in the belief that extrinsic and intrinsic motivation are additive. However, this belief has been challenged by Deci (1971, 1972a, 1972b) and others (cf. Jordan, 1986; Ryan, Mims & Koestner, 1983) who showed that, at least under some circumstances, there is an inverse relationship between extrinsic and intrinsic motivation. That is, once extrinsic incentives are offered for engaging in high frequency (intrinsically motivated) behaviors, the probability of an individual continuing the behavior after the incentives are withdrawn is decreased.

Deci (1975) proposed a cognitive evaluation theory of how incentives may affect intrinsic motivation. First, adding external incentives to intrinsically-motivated behavior may change a person's perceived locus of causality from internal to external. Individuals subsequently perform the behavior only to

attain the extrinsic incentive, reducing intrinsic motivation. Second, adding external incentives to intrinsically motivated behavior may alter (increase or decrease) individuals' feelings of competence and self-determination, since the delivery of the reward provides feedback about the correctness and quality of the behavior. Thus, incentives potentially have either a controlling aspect and/or an informational aspect. Whether the "change in perceived locus of causality" process or the "change in feelings of competence and self-determination" process is invoked depends on which aspect of the incentive (controlling or informational) is more salient. Because of previous experience with monetary inducements, money, commonly used in studying effects of extrinsic incentives on intrinsic motivation, may focus awareness on the controlling process and reduce intrinsic motivation to engage in the task when no incentive is offered.

While numerous studies have demonstrated that incentives, or reinforcers, facilitated performance, others (McGraw, 1978; Chambers, 1979; Eysenck, 1984) have shown that extrinsic incentives may harm performance, as well as motivation. To account for this apparent discrepancy, McGraw (1978) differentiated

tasks along two dimensions: how aversive or attractive they are to the individual performing them, and the way the task is solved, heuristically or algorithmically. Individuals would not be motivated to perform aversive tasks such as lever-pulling if an incentive were not offered. In contrast, activities requiring insight and creativity to produce solutions, such as concept formation and problem solving, are assumed to be inherently interesting, and people perform them without external incentives. In addition, incentives may harm performance on tasks with heuristic solutions while improving performance on tasks with algorithmic solutions.

Eysenck (1984) further suggested that incentives may variously increase attentional selectivity, increase performance speed, decrease accuracy of performance, produce some cognitive inflexibility, and increase short-term storage capacity. He suggested that incentives are arousers and may interfere in cognitive information processing by affecting memory storage and/or retrieval. How the arousal effects of incentives operate will depend on the particular task because the effects are interdependent.

Whether or not men and women react differently to incentives in different circumstances also has been considered and inconclusive findings reported (Deci, 1972a; McGraw, 1978). Deci found that women's motivation was adversely impacted, relative to men's, when the male experimenter was both present during data collection and gave feedback about results.

Another variable that may influence the impact of extrinsic incentives is the initial interest of participants in the task or activity. Since researchers usually selected participants who were high in initial interest, little is known about the importance of this variable (Condry, 1977).

Finally, few studies have dealt specifically with effects of incentives on cognitive processes, and none on cognitive processes involved in problem solving, despite the common practice in education and business of using incentives to motivate or enhance performance in such activity. The present study examined the effects of contingent extrinsic monetary incentives on the motivation for engagement in, and performance on, a cognitive problem-solving task. The problems and context were chosen because they exemplified two ends of the dimensions discussed by McGraw (1978), that is,

they were attractive and they appeared to be heuristic in that there was no immediately apparent algorithm for solution. It was predicted that the offer of money would decrease intrinsic motivation and performance, that there would be no gender differences in motivation, and that initial interest would interact with the offer of money.

Method

Participants

Data from 60 men and 60 women undergraduates at the University of South Florida were analyzed for reporting. Participants'ages ranged from 19 to 55 years, with a mean age of 28 years and a mode of 22 years. Their grade-point averages ranged from 1.75 to 4.00. Before beginning the task, each participant completed an Informed Consent statement required by the university's Human Subjects Committee.

Materials

Interest Questionnaire

To measure initial interest in the experimental task, an Interest Questionnaire was generated in which an example of the kind of problem to be solved later in the study was presented (participants were not told this fact). Participants rated their interest in

solving such problems on a 6-point Likert scale from no interest (1) to great interest (6). The questionnaire also asked participants to rate their experience with, and ability at solving such problems.

Problem Solving Materials Packet

A packet containing an Introduction Sheet, a computer disk, an Answer Sheet, a Personal Data Questionnaire, and an Assessment Questionnaire was developed.

Introduction sheet. The Introduction Sheet stated the purpose of the study was to determine interest in problem-solving activities, and informed participants they would be asked to solve 10 problems later. It also contained directions on placing the disk in the computer disk drive and turning on the computer, a picture of the IBM PC and illustrations of the keyboard of the PC and the PC, Jr.

Problems. The 10 problems used in this study asked participants to provide plausible explanations for seemingly implausible events (Auble, Franks, & Soraci, 1979; Stein, Way, Benningfield, & Hedgecough, 1986). Key concepts for clarifying the implausible statements were embedded in 15 acquisition sentences, or clue statements (10 related and 5 dummy). Each clue

statement contained two words that later would appear in the problem to be solved, so as to facilitate storage and retrieval. Participants had to spontaneously retrieve, transfer and apply the previously stored information (clues) to solve the problems. For example, a clue statement was, "An igloo is a home that can be damaged by the sun." The problem was to write a plausible explanation for the following situation: "The home was small because the sun came out." Five problems were created by Stein et al. (1986) and five by the researcher. All problems were based on Auble et al.'s (1979) problem statements.

Computer disk. A 5 1/4-inch floppy disk contained a researcher-generated program written in compiled Z-Basic. The program provided many of the instructions for completing the problem-solving activity, presented all clue statements, and all of the problems (improbable situation statements) to be solved by the participants. The computer program led participants through the major steps of the study from the point that they completed reading the introductory sheet to the end of the study. Each disk was used by only one participant.

Personal data questionnaire. A researcher-generated instrument asked for academic major, age, sex, grade point average, year in college, and home campus of participants.

Answer sheet. Participants wrote their answers (explanations of the implausiable situations) on an Answer Sheet, numbered 1-10.

Assessment questionnaire. This researcher-generated instrument asked participants to state how many minutes they would volunteer for future similar problem-solving activities when no incentive was offered, and to recall and write the clue statements presented earlier. Also, it asked how many problems participants thought they had answered correctly, whether they had seen any of the problems before, how they felt about having the computer as a mode of presentation, and what they thought the purpose of the experiment was. The groups offered an incentive were also asked how the incentive affected the way they solved problems.

Equipment

IBM PC or IBM PC, Jr. computers with a disk drive and an 80-column monitor were used. Both color and monochrome monitors were used. A Z-BASIC compiler

software package was used for entering code and compiling the program.

Design

Sixty men and 60 women were randomly assigned to one of 12 groups based on incentive, gender and interest level. Four groups received the offer of money prior to the clues (experimental groups I/men and women/high and low interest), four groups received the offer of money after the clues but before the problems (experimental groups II), and four control groups received no offer of money (men and women/high and low interest).

Procedure

Participants completed the Interest Questionnaire prior to random assignment to a treatment group based on their scores. Participants with an interest level of three or higher were assigned to a high initial interest group. The time that elapsed between completion of the Interest Questionnaire and participation in the study varied from 10 minutes to seven days. At the time of solving the problems, each person was given the materials packet described above, and then worked individually at an IBM PC or PC Jr. computer with no experimenter present during the

treatment. However, a helper/monitor was available in another location while participants completed the activity. Participants were asked not to talk during the time they worked, and signs on top of the computer monitors reminded participants not to discuss the activity with others.

Participants read and followed the directions in the Introductory Sheet, described earlier, and started the computer program. The screen displayed a second purpose of the study--to determine the clarity of sentences that might be used to make up problems. Participants were asked to press V for Very Clear, M for Moderately Clear, and U for Unclear for each of the 15 clue sentences that were individually presented on the screen. The purpose of this part of the experiment was to have the participants process the acquisition (clue) sentences and store the sentences in memory. Data regarding which sentences were very clear, moderately clear and unclear were not relevant to the study and were not collected. Participants were told that each sentence would remain on the screen for only a few seconds, so they should quickly make their decision and press the key. Actually, each sentence remained on the screen for 10 seconds.

The four experimental groups I received additional information on the computer screen, just prior to evaluating the clarity of the sentences. These groups were told that they would be paid $.50 for each problem they later solved correctly.

After rating the clue acquisition statements, all participants were asked to complete the Personal Data Questionnaire. Directions for identifying and completing the questionnaire appeared on the computer screen. The Personal Data Questionnaire directed participants to return to working on the computer after its completion.

Next, the problems were presented on the screen to all participants. However, just before the problems were presented, experimental groups II were told for the first time, and experimental groups I were told again, that they would receive $.50 for each problem solved correctly. The control groups received no offer of an incentive for solving problems. All participants were told, on the screen, that the sentences they just rated for clarity might help them to solve the 10 problems and that each problem would appear on the screen for 40 seconds. They were to write its solution on the Answer Sheet provided in the packet.

Participants could, upon completion, go on to the next one sooner than 40 seconds by pressing a computer key. If participants had not completed an answer within the 40-second time span, the computer beeped and presented a new problem on the screen. After the fifth problem, experimental groups I and II were reminded on the screen that they would earn $.50 for each problem solved correctly, while control group participants were told they had completed half of the problems. The computer timed the total number of seconds spent solving the 10 problems.

Following problem completion, participants were directed to the first part of the Assessment Questionnaire and asked to press a key (to time the number of seconds they spent recalling clues). After completing the first part of the Assessment Questionnaire and pressing a key to so indicate, instructions on the computer screen directed participants to complete the remainder of the Assessment Questionnaire. Participants were thanked and incentive groups were told how their money would be distributed. All participants were asked to keep the content of the experiment confidental.

Results

Number of Minutes Volunteered (Intrinsic Motivation)

Cell means and standard deviations for the number of minutes volunteered to participate in future similar problem-solving activities when no incentive would be offered (as stated on the Assessment Questionnaire) are presented in Table 1. As predicted, the eight experimental groups volunteered for less time than the four control groups. When collapsed across gender and level of interest, the mean number of minutes volunteered was 21.38 minutes for experimental groups I, 22.62 for experimental groups II, and 81.88 for control groups, F (2,108) = 88.17, $p < .001$.

A Fisher's Least Significant Difference (LSD) Test (Keppel, 1973) used to compare these three means indicated that the amount of time volunteered by the four experimental groups I and the four experimental groups II did not differ, but that they both differed from the collapsed control groups means, LSD = 10.31.

Insert Table 1 about here

As predicted, men and women did not differ in the mean number of minutes voluteered. Men volunteered for

41.83 minutes and women, 42.08, F (1,108) = .00, p = .95.

Although the prediction was made that high initial interest incentive groups would volunteer for less time than low initial interest control groups, this did not happen ($\bar{X}$ high = 42.33 minutes and $\bar{X}$ low = 43.42), F (2,108) = 0.31, p = .74.

Number of Problems Solved (Performance)

Two trained raters independently rated all participants' answers to all problems and clues recalled. The answers to the problems were considered correct if they included the key concept (e.g., "igloo") together with some explanation of how that concept was relevant to the solution of the problem. Raters referred to a list of key concepts when rating the problems. Interrater reliability exceeded 99% for number of problems solved correctly, and 98% for clues recalled. Ninety-nine participants earned money for solving problems, based on the raters' results.

The means and standard deviations for number of problems solved are presented in Table 2.

As can be seen from Table 2, overall, incentive groups solved fewer problems than the control groups,

as predicted, F (2,108) = 10.18, $p < .001$. The means for the experimental groups (4.68 and 4.45 for groups I and II, respectively) were both significantly lower than the control group mean (6.95), LSD = 1.21.

Insert Table 2 about here

The prediction that the experimental groups that received the offer of the incentive before the clues would solve fewer problems than the experimental groups that received the incentive after the clues was not supported, LSD = 1.21.

Although not hypothesized, women, across all groups, solved significantly more problems ($\bar{X}$ = 5.98) than men ($\bar{X}$ = 4.73), F (1,108) = 6.23, p = .014. As hypothesized, in the incentive groups, men solved fewer problems ($\bar{X}$ = 3.80) than women ($\bar{X}$ = 5.32), F (1,76) = 5.18, p = .03.

Further, experimental groups women with low interest solved significantly more problems (6.00) than low interest experimental men (3.15), F (1,76) = 3.91, p = .052. The difference between low interest women and high interest women (4.65) and high interest men (4.45) was not significant.

The further prediction that men in the control groups would solve more problems than women in the control groups was not supported. (Control group men solved a mean of 6.60 problems versus women's mean of 7.30, F (1,36) = 1.01, p = .32.)

Number of Clues Recalled (Arousal)

No significant effects were found in the number of clues recalled, the measure used to assess the arousal effect of the offer of money on information processing memory storage and retrieval.

Relevant Versus Irrelevant Clue Recall

Clues were divided into relevant clues (those related to the 10 problems participants were asked to solve) and irrelevant clues (the five filler clues that were not related to the problems). As anticipated, all participants recalled a significantly larger mean percentage of the relevant clues (.64) than irrelevant clues (.55), t (119) = -4.10, $p < .001$). The difference among experimental and control groups in the percentage of relevant clues recalled (.60, .65, and .67, respectively, for groups I, II and control) was not significant, F (2,108) = .80, p = .45. There was, however, a main effect of interest on the percentage of irrelevant clues recalled. High interest participants

recalled a significantly larger percentage (.63) than low interest participants (.48), F (1,108) = 8.16, p = .005 as might be expected.

Time Spent Solving Problems and Recalling Clues

Experimental groups I, experimental groups II, and control groups did not differ in the time spent solving problems, F (2,108) = 0.11, p = .90, or the time spent recalling clues, F (2,108) = 0.32, p = .73.

Discussion

The present investigation explored the motivational and performance effects of offering an incentive (money) for completing a cognitive problem-solving task. Further, the study examined the arousal effects of incentives on information processing memory storage and retrieval.

Clue statements related to problems were presented. Later, participants retrieved and used the clues to write plausible explanations for implausible situations. The independent variable was the offer of money, presented before or after the clues. Two quasi-independent variables were gender and interest level. Three main dependent measures were intrinsic motivation (minutes volunteered to participate in future similar activities when no incentive would be

offered), performance (problems solved correctly), and arousal (number of clues recalled) a process variable measuring the arousal effects of incentives on memory storage and retrieval.

Data on time-on-task were collected to ascertain whether or not time-on-task might account for any of the results. In fact, there were no significant differences in mean amounts of time the experimental and control groups spent on either problem solving or recalling clues.

Money greatly affected the intrinsic motivation of participants since the mean number of minutes volunteered by control groups was about 60 minutes greater than by experimental groups ($F = 88.17$). This finding can be taken as support for Deci's (1975) cognitive evaluation theory. He argued that people changed their reason for performing an intrinsically motivating activity from an internal to an external one (obtaining the incentive). That is, when asked about performing the activity, participants who received money said they would spend much less time than those who had not been rewarded. Presumably, their intrinsic motivation for the activity was diminished. In this study, the informational aspect of money was nil. That

is, participants did not know how many problems they solved correctly, nor how much they were earning as they progressed, so that their sense of competency through feedback could not be increased. In addition, participants did not know how and when payment would be made until they had completed the task. Payment was set at a specific time and place several weeks later. Participants could also anonymously request payment by mail. Only five individuals appeared to collect, and one sent a mail request. Why this happened is not clear, but the result suggests that the mere offer of an incentive, versus actual payment of a reward may detrimentally affect intrinsic motivation. These two conditions--contingency without knowledge of performance, and performance without knowledge of payment terms were unique to this study.

Using the computer so that no experimenter was present while the task was being performed was also unique to this study. This was a deliberate attempt to avoid any covert feedback an experimenter might have provided or any other demand from an experimenter's presence that participants might have perceived, a situation that apparently affected intrinsic motivation in other studies (Pritchard, Campbell, & Campbell,

1977). Thus, when the factor of feedback about competence is eliminated, it appears that extrinsic incentives very powerfully interfere with intrinsic motivation.

That there was no difference in the changes in intrinsic motivation between men and women supports earlier findings (Deci, 1972a) that incentives do not differentially affect the intrinsic motivation of men and women if the experimenter is not physically present and external feedback about performance is not provided.

The lack of a predicted interaction between initial interest and the offer of an incentive might hinge on the fact that, overall, participants' ratings in this study of their interest in the task were somewhat low. In fact, ratings of three and above were assigned to high interest because few participants marked six in a series of pilot studies conducted to develop the materials and procedures. Earlier, Deci (1972b) and McGraw (1976) had shown that interest in and intrinsic motivation for, a task were separate constructs. Apparently, this was the case in this study. However, a difficulty in evaluating these results might lie in the instrument used to measure

interest. Participants were shown one problem (with no clue statement) on paper, and asked how interested they were in solving it. Informally, after working on the computer, seeing the array of problems, and being challenged to recall the clues, participants indicated the task was more interesting than they thought it would be, and their volunteering for long periods of time would indicate that they did find the task interesting. Since participants received no clue for the example problem, they rated their interest without knowing the scope of the task. In future studies, researchers might elect to measure interest as a covariate, as opposed to controlling by the initial selection process. In this study, a low interest rating may not be a function of lack of interest, but of an inadequate measurement procedure.

As predicted, performance, as well as intrinsic motivation, was detrimentally affected by the offer of an incentive. McGraw (1978) postulated that performance on an attractive (intrinsically motivating) task with a heuristic solution would be detrimentally affected by incentives, and it appears that this happened. A further prediction about performance, based on Eysenck's (1984) description of incentives as

arousers with the capability of disrupting memory storage and retrieval, was that groups receiving the offer of an incentive prior to the clue statements would solve fewer problems than those receiving the offer after the clues. This did not happen. However, Eysenck also suggested that incentives might produce multiple, interrelated cognitive effects, including increased attentional selectivity, increased performance speed, decreased accuracy, cognitive inflexibility, and increased short-term storage capacity. It may have been that here incentives, rather than disrupting memory storage, in fact, by increasing short-term memory, enhanced storage. This area deserves further study.

An unpredicted finding of this study was that women in all groups solved significantly more problems than men. A possible explanation might be that women selected for the study (primarily students in Education) were more academically talented. In fact, they had a higher mean grade point average (3.39) than the men in this study (3.08), and grade point average was shown to positively correlate with number of problems solved correctly, (r = .18, P = .01).

Women with low initial interest in the task, when offered an incentive, solved statistically more problems than their male counterparts. There was a tendency for low interest women to perform better than high interest men and women also. That low interest women respond to incentives for performance may not be unusual, given that women may be more socialized to conform to external demands (Seager & Olson, 1986).

Eysenck's (1984) suggestion that incentives as an arouser might disrupt information processing storage and retrieval was also the basis for predicting that experimental groups would recall fewer clues than control. However, there were no differences. Since recalling clues was not assumed to be intrinsically motivating, nor a heuristically-solved problem-task, this result fits McGraw's (1978) hypothesis that task performance will be detrimentally affected by the offer of an incentive only if the task is attractive (intrinsically motivating) and heuristic in solution.

Since experimental groups I and II did not differ on recall, the effects of incentives on information processing memory storage and retrieval are not clear in this study. A confounding situation may have been present. The problems prompted participants to recall

a larger percentage of clues associated with the problems (relevant clues) than filler sentence clues not associated with the problems (irrelevant clues). The recall of clues was a cued-recall task. Participants were given the key concept and asked to write the clue statement. How incentives would impact recall without cues might be different.

In sum, data from this study add to the mounting evidence that the offer of incentives to perform certain inherently-motivated activities may detrimentally affect both motivation to engage in the activity later when no incentive is offered and performance. Organizations and educational institutions that offer bonuses, prizes, and grades for performance should be aware of this phenomenon, since employee and student intrinsic motivation is important for productivity and success. In this study, as in many real-life situations, participants did not know, as they were performing, how much they were earning or how they would be paid, and intrinsic motivation for the task, and performance on the task, was detrimentally affected. Organizational leaders may want to examine policies of offering incentives for performance without first assessing the intrinsic

motivational level of the activity, particularly when cognitive problem-solving tasks are involved.

References

Auble, P. M., Franks, J. J., & Soraci, S. A. (1979). Effort toward comprehension: Elaboration or "aha"? Memory & Cognition, 7, 426-434.

Chambers, J.C. (1979). The effects of the presence or absence of rewards on the problem-solving process. Dissertation Abstracts International, 40, 3981B. (University Microfilms No. DEM80-03905).

Condry, J. (1977). Enemies of exploration: Self-initiated versus other initiated learning. Journal of Personality and Social Psychology, 35, 459-477.

Deci, E. L. (1971). Effects of externally mediated rewards on intrinsic motivation. Journal of Personality and Social Psychology, 18, 105-115.

Deci, E. L. (1972a). Intrinsic motivation, extrinsic reinforcement, and inequity. Journal of Personality and Social Psychology, 22, 113-120.

Deci, E. L. (1972b). The effects of contingent and non-contingent rewards and controls on intrinsic motivation. Organizational Behavior and Human Performance, 18, 217-229.

Deci, E. L. (1975). Intrinsic motivation. New York: Plenum Press.

Eysenck, M. W. (1984). A handbook of cognitive psychology. Hillsdale, NJ: Erlbaum.

Jordan, P. C. (1986). Effects of an extrinsic reward on intrinsic motivation: A field experiment. Academy of Management Journal, 29(2), 405-412.

McGraw, K. O. (1976). Monetary reward and water-jar task performance: Evidence of a detrimental effect of reward on problem-solving. Dissertation Abstracts International, 37, 2548b. (University Microfilms No. 76-24, 386).

McGraw, K. O. (1978). The detrimental effects of reward on performance: A literature review and a prediction model. In M. R. Lepper & D. Greene (Eds.), The hidden costs of reward (pp. 33-57). Hillsdale, NJ: Erbaum.

Pritchard, R. D., Campbell, K. M., & Campbell, D. J. (1977). Effects of extrinsic financial rewards on intrinsic motivation. Journal of Applied Psychology, 62, 9-15.

Ryan, R. M., Mims, V., & Koestner, R. (1983). Relation of reward contingency and interpersonal context to intrinsic motivation: A review and test using cognitive evaluation theory. Journal of Personality and Social Psychology, 45(4), 736-750.

Seager, J. & Olson, A. (1986). Women in the world: An international atlas. New York: Simon & Schuster.

Stein, B. S., Way, K. R., Benningfield, S. E. & Hedgecough, C. A. (1986). Constraints on spontaneous transfer in problem-solving tasks. Memory & Cognition, 14(5), 432-441.

Author Note

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Table 1

Means and Standard Deviations for Number of Minutes Volunteered[a]

	Exp. Groups I		Exp. Groups II		Control Groups	
	Mean	SD	Mean	SD	Mean	SD
Men						
Low interest	24.00	16.47	23.00	20.98	87.50	26.38
High interest	22.00	16.70	23.00	16.87	71.50	25.61
Women						
Low interest	15.50	18.33	29.00	24.24	81.50	33.34
High interest	24.00	22.21	15.50	10.40	87.00	35.30
Mean	21.38		22.62		81.88	

[a] n = 10 per cell.

Table 2

Means and Standard Deviations for Number of Problems Solved[a]

	Exp. Groups I		Exp. Groups II		Control Groups	
	Mean	SD	Mean	SD	Mean	SD
Men						
Low interest	3.80	3.19	2.50	2.59	6.60	2.01
High interest	4.20	3.05	4.70	2.90	6.60	2.60
Women						
Low interest	5.60	3.20	6.40	3.27	6.30	2.36
High interest	5.10	2.73	4.20	2.97	8.30	1.42
Mean	4.68		4.45		6.95	

[a] n = 10 per cell.